

UNITED STATES DISTRICT COURT  
DISTRICT OF MASSACHUSETTS

CIVIL ACTION NO. 12-12218-RGS

LEXINGTON LUMINANCE LLC

V.

GOOGLE, INC.

MEMORANDUM AND ORDER  
ON CLAIM CONSTRUCTION

March 29, 2016

STEARNS, D.J.

In this intellectual property dispute, plaintiff Lexington Luminance, LLC, accuses defendant Google, Inc., of infringing U.S. Patent No. 6,936,851 (the '851 patent). Before the court are the parties' competing briefs on claim construction. The court received tutorials in the underlying technology and heard argument, pursuant to *Marksman v. Westview Instruments, Inc.*, 517 U.S. 370 (1996), on March 28, 2016.

BACKGROUND

The '851 patent is entitled "Semiconductor Light-Emitting Device and Method for Manufacturing the Same." It lists the inventor as Dr. Tien Yang Wang. The '851 patent originally issued on August 30, 2005, and

after an ex-parte reexamination, was reissued on December 5, 2014. The reissued patent sets out 18 claims.

The '851 patent teaches an improvement in the manufacture of light-emitting diodes (LEDs). LEDs are semiconductor devices that convert electricity to visible light, and generally consist of layers of material deposited on a base material known as a substrate. A lattice mismatch can occur when the substrate material and the deposited layer material have different crystal structures that are incompatible in their atomic arrangements. See '851 patent, col. 1, ll. 18-20. A mismatch can cause cracks and dislocations in the layers, see *id.*, col. 1, ll. 20-22., which has the effect of degrading the performance of the LED and limiting the size of wafers that can be effectively manufactured.

The '851 patent offers a solution to the lattice mismatch problem that uses a substrate with a “textured district [that] comprises a plurality of smooth trenches without a prescribed angle of inclination.” *Id.* col. 2, ll. 22-25.

The controlled layer deposition over the textured surface district proceeds such that the inclined layer growth in the trench region diminishes in the early stage of the process. Since the threading dislocations propagate along the growth direction, they are guided towards designated location and confined therein. The free propagation of the dislocation defects is thus restricted and the defect density in the active layer is significantly reduced. . . .

This allows for the nucleation of smooth semiconductor layers over the energetically favorable sites.

*Id.* col. 2, ll. 15-26. Figures 1A-C and 2A-B of the patent, reproduced below, demonstrate how embodiments of “trenches and mesa[s] having a smooth rotation of micro-facets” channel dislocations to designated locations and reduce defects in the active (top) layer of the LED. *Id.*, col. 3, ll. 36-37.



Fig. 1A

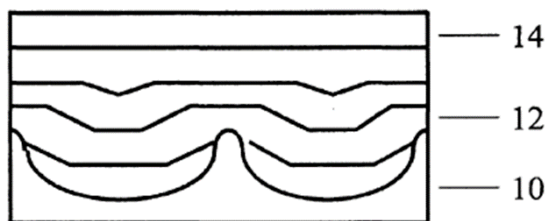


Fig. 1B

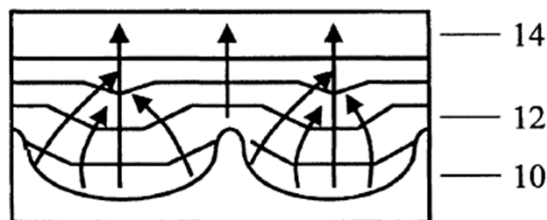


Fig. 1C

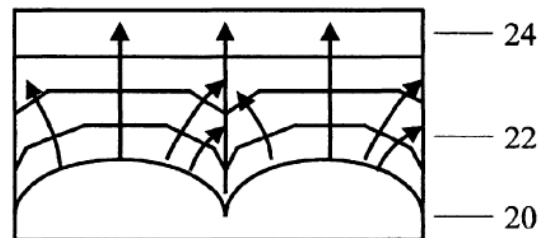


Fig. 2A

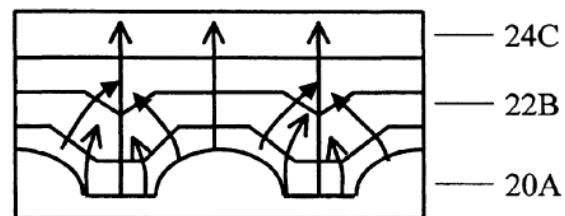


Fig. 2B

In this action, Lexington Luminance asserts Claim 1. Claim 1, as amended by the reexamination certificate, recites “[a] semiconductor light-emitting device comprising”

a substrate;

a textured district defined on the surface of said substrate comprising a plurality of etched trenches having a sloped etching profile with a smooth rotation of microfacets without a prescribed angle of inclination;

a first layer disposed on said textured district, comprising a plurality of inclined lower portions, said first layer and said substrate form a lattice-mismatched misfit system, said substrate having at least one of a group consisting of group III-V, group IV, group II-VI elements and alloys, ZnO, spinel and sapphire; and

a light-emitting structure containing an active layer disposed on said first layer, whereby said plurality of inclined lower portions are configured to guide extended lattice defects away from propagating into the active layer.

The parties dispute the proper construction of “a sloped etching profile with a smooth rotation of microfacets without a prescribed angle of inclination,” “layer,” “disposed on,” and the phrase, “whereby said plurality of inclined lower portions are configured to guide extended lattice defects away from propagating into the active layer.”<sup>1</sup>

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<sup>1</sup> The parties have agreed on the construction of 10 other claim terms. See Dkt. # 106-1 at 1. In debating whether the re-examination substantially altered the claim scope, the parties also dispute the construction of the phrase “so as to guide the extended lattice defects away from the propagating into the active layer.” The “so as to” phrase appeared in original Claim 1 of the '851 patent prior to the re-examination:

... a first layer disposed on said textured district, comprising a plurality of inclined lower portions [so as to guide the extended lattice defects away from the propagating into the active layer,] said first layer and said substrate form a lattice-mismatched misfit system, said substrate having at least one of a group

## DISCUSSION

Claim construction is a matter of law. *See Marksman*, 517 U.S. at 388-389. Claim terms are generally given the ordinary and customary meaning that would be ascribed by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-1313 (Fed. Cir. 2005) (en banc) (citations omitted). In determining how a person of ordinary skill in the art would have understood the claim terms, the court looks to the specification of the patent, its prosecution history, and in limited instances where appropriate, extrinsic evidence such as dictionaries, treatises, or expert testimony. *Id.* at 1316-1317. Ultimately, “[t]he construction that stays true to the claim language and most naturally aligns with the patent’s description of the invention will be, in the end, the correct construction.” *Id.* at 1316 (citation omitted).

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consisting of group III-V, group IV, group II-VI elements and alloys, ZnO, spinel and sapphire . . .

The reissued Claim 1 replaced the “so as to” phrase with the “whereby” phrase at the end of the claim.

- A. “a sloped etching profile with a smooth rotation of microfacets without a prescribed angle of inclination”

*“microfacet”*

Lexington Luminance contends that “microfacets” are “very small planes that make up a surface contour.” Google, while not disputing that “microfacets” are small planar surfaces, would assign a dimensional restriction limiting the claim to read “planar crystal surfaces that have a width of from 1 to 1000 micrometers.” As support, Google recites what it characterizes as a “common understanding” of the *micro*- prefix as referring to micrometers. Google also reaches back to the court’s construction of “microparticles” in *Cephalon, Inc. v. Celgene Corp.*, 985 F. Supp. 2d 171, 175-178 (D. Mass 2013), *aff’d*, 618 Fed. App’x. 663 (Fed. Cir. 2015), as “particles having a diameter between 1 and 1000 microns.”

Neither of Google’s supporting rationales is germane. The *micro*- prefix is more commonly used to mean very small (relatively) than as a reference to a specific unit of measurement (microbiology, microcosm, microcomputer, microeconomics, and microfilm, to give a few examples). The ’851 patent uses the term “microfacets” in the context of an etching profile having a “smooth rotation of microfacets.” ’851 patent, col. 3, l. 37; col. 4, ll. 12-13. All that is required of microfacets is that they be small enough that their rotation on the “trenches and mesa(s)” of the etching profile

approximates smooth. Nothing in the '851 patent requires or even suggests precise parameters of size. In contrast, the patent in *Cephalon* provided a numeric size range for the particles it contemplated, and contrasted microparticles with nanoparticles within that range. *See Cephalon*, 985 F. Supp. 2d at 175. Google also has not offered evidence that the term “micro” was understood by persons of ordinary skill in LED fabrication to impose dimensional limits. Consequently, the court will reject Google’s proposal for a specific size range and adopt Lexington Luminance’s proposed construction.

*“a sloped etching profile with a smooth rotation of microfacets”*

Lexington Luminance contends that this phrase needs no construction and should be given its plain and ordinary meaning. In the alternative, Lexington Luminance proposes the construction: “sloped etched sides without sharp corners.” Google, for its part, advances the construction: “when viewed in cross-section, multiple microfacets with a gradual incremental rotation in slope from microfacet to microfacet such that there are no sharp corners formed by an etching process.”

Lexington Luminance objects to Google’s use of the term “cross-section” to define the etching profile. Lexington Luminance argues that the term “cross-section” reduces three-dimensional etching profiles to two

dimensions, and also that the term too broadly captures shapes not claimed by the patent (such as conoids that have parabolic cross-sections). Although the etched trenches on the textured district of the substrate are certainly three-dimensional, there is nothing that suggests that the word “profile” is used in the patent to refer to anything other than its commonly understood meaning, that is, an outline view from the side. *See, e.g.*, col. 3, ll. 19-20 (describing a two-dimensional side view of the etching process in progress as the “crystallographic *etching profile*”). When viewed from the side in outline, all three-dimensional objects appear in two dimensions. This common understanding of the term “profile” also excludes shapes like conoids.<sup>2</sup>

The remainder of Google’s construction is largely consistent with Lexington Luminance’s own description of the invention during the re-examination process. Given “that the sloped surface of the trench is made up of many very tiny facets, a smooth rotation of these microfacets approximates a smooth, curved surface.” Decl. of David P. Bour, Ph.D. in Support of Patent Owner’s Response to Office Action, May 13, 2014, Dkt. 98-5 at 7. The court’s remaining hesitation about Google’s proposed

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<sup>2</sup> When viewed in outline from the side, conoids are angular in shape and do not have a smooth rotation of microfacets.



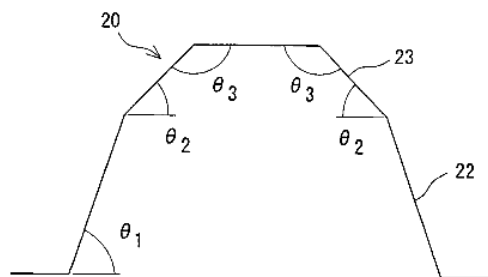
construction – that it requires “a gradual incremental rotation in slope” when the slope of the rotation may both increase and decrease – is resolved by Dr. Bour’s plainer language. The court will adopt a modified restatement of Lexington Luminance’s characterization of its invention and construe “a sloped etching profile with a smooth rotation of microfacets” to mean “when viewed in outline from the side, the trenches have etched sloped sides made up of a rotation of microfacets that approximate a smooth curve.”

*“a sloped etching profile . . . without a prescribed angle of inclination”*

Like the term “smooth rotation of microfacets,” Lexington Luminance believes this term should be accorded its plain and ordinary meaning, that is: “sloped etched sides without a constant angle of inclination.” Google proposes the construction: “when viewed in cross section, [a sloped etching profile] formed by an etching process wherein an angle of inclination is not controlled for.” The dispute centers on how to interpret the word “prescribed.” Lexington Luminance contends that because the patent distinguished prior art trenches that contained straight line segments in profile and straight lines have a constant slope, “prescribed” should mean constant. Google asserts that the evidence equally supports its definition, as segments of straight lines also have a controlled slope.

While Lexington Luminance is correct that the slope of a straight line segment is constant, the term “without a prescribed angle of inclination” modifies the entire etching profile, and not only its constituent segments. Reproduced below is a figure from United States Patent No. 7,683,386 (Tanaka), cited by Lexington Luminance as distinguishable prior art in the construction of this term. See Lexington Luminance Opening Br. at 4.

*Fig. 5A*



Here, the trench sides are made up of multiple straight line segments with different slopes. As Tanaka explains,

FIG. 5A shows an example of a cross section of the protrusion, in which case the side face of the protrusion includes two sloped surfaces having different angles of inclination  $\theta_1$  and  $\theta_2$ . A number of sloped surfaces is not limited to two, and may be larger. That is, angles of inclination are not limited to  $\theta_1$  and  $\theta_2$ , and  $n$  kinds of angles of inclination up to  $\theta_n$  ( $n$  is an integer) may be provided.

Tanaka, Col. 2, l. 63 – Col. 3, l. 3. Thus, although Tanaka “prescribed” the angles of inclination of the etching profile, the angles were not constant.

Google’s proposed construction more accurately reflects the use of the term “prescribed” in the patent. See ’851 patent col. 1, ll. 66-67 (equating

“prescribed surface feature” with “surface features with a specific inclination angle”). Lexington Luminance objects that the term “controlled for” is ambiguous because the angles of an approximately-smooth curve may be “controlled for” by higher order mathematical expressions such as parabolic equations. To afford greater clarity, the court will construe “without a prescribed angle of inclination” as “without a predetermined angle of inclination.”

B. “layer”

The parties agree that a “layer” must be “a thickness of material” that “does not refer to a substrate,” but disagree as to whether that thickness of material “may be made up of sublayers” (Lexington Luminance), or whether it must be “homogeneous” (Google).

Lexington Luminance contends that a layer is understood by those skilled in the art to include sublayers. In support, it cites to *Seoul Semiconductor Co. Ltd. v. Nichia Corp.*, 596 F. Supp. 2d 1005, 1015-1016 (E.D. Texas 2009), in which the court construed the term “layer” in the context of United States Patent no. 5,075,742 (the ’742 patent) when directed to semi-conductor structure as “a thickness of material, which may be made up of sub-layers, but does not refer to a substrate in a device unless the substrate is an electronically active portion of the device.” In *Seoul*,

however, the patent-in-suit explicitly taught the inclusion of sub-layers of material that have a forbidden band gap that is less than the band gap of the layer.<sup>3</sup> *Id.* at 1018-1020.

Lexington Luminance’s reliance on United States Patent No. 6,452,216 (Tsuda) is similarly unpersuasive. Tsuda expressly defined the term “emission layer” to “stand[] for a layer including at least one quantum well layer or a plurality of barrier layers alternately stacked with such a quantum well layer.” Tsuda, col. 3, ll. 35-37. Because these reference defined “layer” in their unique contexts to include specific types of sublayers, the court does not find them as persuasive evidence that the term “layer” is ordinarily understood in the art to include sublayers. In the context of the ’851 patent, the term “layer” is not used to include sublayers and each different layer is separately defined. *Compare* Claim 3 with Claim 1 (reciting “buffer layer” as distinct from “first layer”).

In support of its position that a layer is homogeneous, Google relies on the examples of layers provided by the specification, all of which consist of a single type of material. *See, e.g.*, ’851 patent col. 1, ll. 44-46 (“Thus a

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<sup>3</sup> That the *Seoul* construction is specific to the ’742 patent is also reflected in the fact that in some instances in *Seoul* a substrate is considered to be a layer, while the parties agree that “layer” in the context of the ’851 patent excludes substrates.

GaAs layer is first grown on the Si substrate using molecular beam epitaxy); l. 54 (“GaN layer on SiC substrate”). Lexington Luminance objects that Google is “read[ing] a limitation from the specification into the claims.” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 904 (Fed. Cir. 2004). That said, the conclusion that a “layer” is regular in its atomic structure is compelled by the parties’ agreed upon definition for “lattice-mismatched misfit system.” It will be recalled that Claim 1 requires that “said first layer and said substrate form a lattice-mismatched misfit system.” A “lattice-mismatched misfit system” is “a system in which a crystal layer exhibiting one lattice constant is disposed on a substrate that exhibits a different lattice constant.” Joint Claim Construction Statement, Dkt. 106-1. One can infer, therefore, that the “layer” exhibits a “lattice constant” and (as is generally true of crystal structures) is regular in the pattern of its atomic arrangement. Accordingly, the court will construe “layer” as “a thickness of material exhibiting a lattice constant that does not refer to a substrate.”

### C. “disposed on”

The parties agree that “disposed on” means at least “applied directly upon,” but disagree whether the term also permits indirect application (Lexington Luminance asserts that it does, Google that it does not). Claim 1 recites elements that “compris[e]” a semiconductor light-emitting

device. We begin with the presumption created by “[t]he transition [word] ‘comprising’ . . . that the claim does not exclude additional, unrecited elements.” *ArcelorMittal France v. AK Steel Corp.*, 700 F.3d 1314, 1320 (Fed. Cir. 2012). Nothing in the intrinsic record serves to rebut this presumption.

The specification strongly implies that “disposed” may be taken in both the direct and indirect senses. In identifying the problem to be solved, the patent states that “the quality of the *directly disposed* layer is inferior due to penetration of threading dislocations in this material system.” ’851 patent, col. 1, ll. 20-22 (emphasis added). In contrast, an embodiment of the invention illustrated by Figure 5C permits the use of intervening materials not expressly claimed.

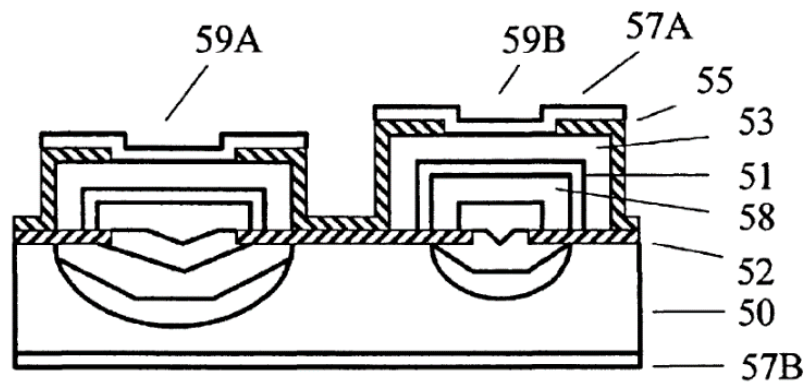


Fig. 5C

“As illustrated in FIG. 5C, a light-emitting device is disposed on the surface of the chirped mask array 52 comprising a buffer layer, a lower cladding layer 55, an active layer 51, an upper cladding layer 53, and a contact layer.” *Id.*

col. 7, ll. 21-25. Claim 5 of the '851 patent (directed to embodiments including mask districts on the substrate) requires “a light-emitting structure containing an active layer disposed on said first layer.” In Figure 5C, the chirped mask array is disposed between the “first layer” on the substrate and the “light-emitting structure.”

Nor does anything in the prosecution history clearly disavow indirect application. *See Liebel-Flarshiem*, 358 F.3d at 913. Google suggests that Lexington Luminance narrowed the scope of “disposed” by distinguishing the Ota prior art reference, where the textured district was disposed on a buffer layer on the substrate. *See* May 14, 2014 Response to Office Action, Dkt. # 98-6 at 14. However, Claim 1 is clear that the texture substrate is “defined” on the substrate. Thus, the distinguishing argument is of little value in understanding the term “disposed” as it is used in the claim. Google also points to Lexington Luminance’s validity arguments distinguishing the Tsuda and Tadatomo prior art references as not disclosing “first layer disposed on said texture district” because those references disclosed first layers suspended over gaps in the substrate. *See* Preliminary Responses to Invalidity Contentions, Dkt. 98-10 at 6-8, 12-14. However, Lexington Luminance distinguished those references not because they were indirect applications, but on the basis that the first layer was laterally grown from the

side, and thus were not “applied on” the substrate. Because the intrinsic evidence does not justify a narrower construction, the court will construe “disposed on” as “applied directly or indirectly above.”

D. “whereby said plurality of inclined lower portions are configured to guide extended lattice defects away from propagating into the active layer” and “so as to guide extended lattice defects away from propagating into the active layer”

The parties dispute whether the claim phrase, “whereby said plurality of inclined lower portions are configured to guide extended lattice defects away from propagating into the active layer,” is a limitation at all. “A ‘whereby’ clause that merely states the result of the limitations in the claim adds nothing to the patentability or substance of the claim.” *Texas Instruments Inc. v. U.S. Int’l Trade Comm’n*, 988 F.2d 1165, 1172 (Fed. Cir. 1993). On the other hand, “whereby” clauses that define a structural limitation are claim limitations. *See Scheinman v. Zalkind*, 112 F.2d 1017, 1019 (CCPA 1940). Lexington Luminance contends that Google’s proposed construction of “shaped to reduce the propagation of extended lattice defects into the active layer” does nothing more than restate the goal of the ’851 patent. *See* ’851 patent, col. 1, ll. 10-15 (“In particular, the lattice defects are guided to and contained in designated locations defined by textured districts on the substrate surface. As a result, the free propagation of extended defects



through the active region is restricted and the overall defect density of the system is reduced.”).

Google in response asserts that Lexington Luminance is judicially estopped from asserting that the “whereby” phrase is not a claim limitation because Lexington Luminance convinced another district court and the Federal Circuit that the corresponding “so as to” phrase of the original Claim 1 was in fact a definite limitation. *See Lexington Luminance v. Amazon*, 601 Fed. App’x 963, 969 (Fed. Cir. 2015) (affirming that the “so as to” phrase is a definite claim limitation). “[Judicial estoppel] operates to prevent a litigant from taking a litigation position that is inconsistent with a litigation position successfully asserted by him in an earlier phase of the same case or in an earlier court proceeding.” *Perry v. Blum*, 629 F.3d 1, 8 (1st Cir. 2010). During the re-examination process, Lexington Luminance explained that “Claim 1 was [] amended to more particularly point out that the plurality of inclined lower portions of layer 1 guide extended lattice defects away from propagating into the active layer.” *See* May 14, 2014 Response to Office Action, Dkt. # 98-6 at 7. This clarifying amendment did not substantively alter the original claim scope and Lexington Luminance’s prior successful argument applies with equal force to the “whereby” phrase.

The conclusion that the “whereby” phrase includes a structural limitation is also compelled in the context of the claim as a whole. The “whereby” phrase describes not the intended result of the textured district of the substrate, but the “configur[ation]” of the “inclined lower portions” of the “first layer.” Because the court has adopted Lexington Luminance’s proposal that “disposed on” does not mandate direct application, the first layer is not necessarily disposed directly on the substrate and its lower inclined portions do not necessarily adopt the shape of the etched trenches of the substrate. The “whereby” clause, therefore, independently limits the structure of the inclined lower portions of the first layer. The court will construe both the “whereby” and the “so as to” phrases as meaning: “such that the inclined lower portions are shaped to reduce the propagation of extended lattice defects into the active layer.”

**ORDER**

The claim terms at issue will be construed for the jury and for all other purposes in a manner consistent with the above rulings of the court.

**SO ORDERED.**

/s/ Richard G. Stearns

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**UNITED STATES DISTRICT JUDGE**